

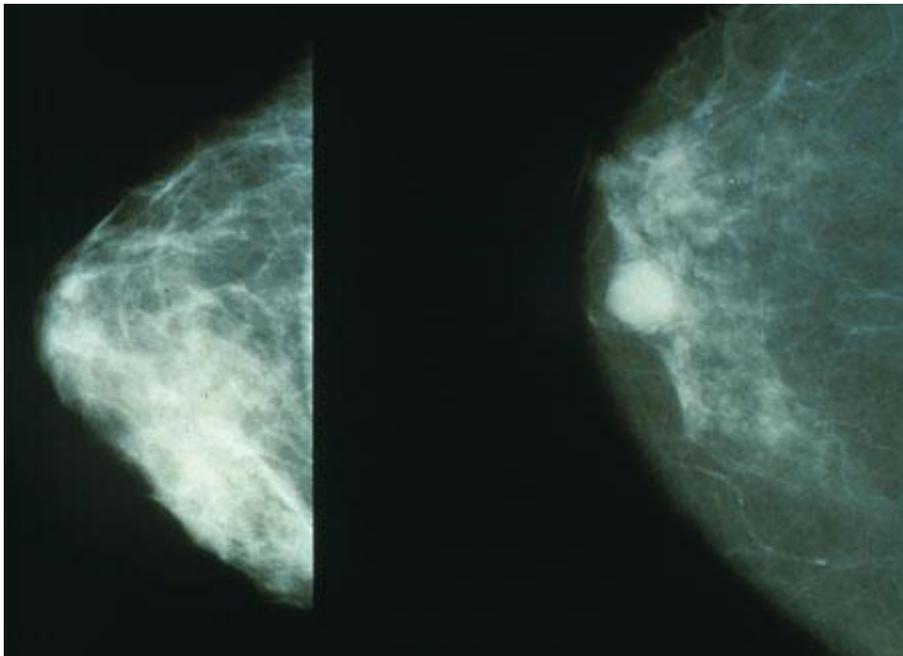
Swedish National
Breast Cancer Study

Karma

Karma Imaging variables

Karma collects all RAW and processed images from women participating in the study. The images are collected from the mammographic screening where the women are recruited to Karma. Karma collects images at the time the women comes to Karma, and also retrospective and prospective images. The images are further processed in Karma for calculation of breast density.

The following picture shows an example of a normal breast and a breast with cancer.



Karma holds the following imaging variables. Note that a woman usually has 4 images per mammography visit (two images from above, called CC view, and two images diagonal from the side, called MLO view. For each view one image is for right breast and one is for left breast. A woman can also have images from several mammography visits.

Image tag data

Each mammogram holds metadata in so called tags describing image characteristics. The names are according to the DICOM standard (<http://medical.nema.org/>)

quality

Raw or processed image. (Raw images appear all white to the eye and images are therefore processed in order to make images viewable by the eye)

digital

Digital or analog digitized image.

manufacturer

Manufacturer of machine used for mammography.

manufacturersmodelname

Model of machine used for mammography.

stationname

Name of a machine placed in a certain room. (Same name can be used for different machines and same machine can have different names if they were placed in another room)

viewposition

View position of breast, e.g. CC, MLO.

imagelaterality

Left or right breast imaged.

exposuretime

Exposure time in milliseconds.

xraytubecurrent

X-ray current in tube, mA.

exposure

Radiation exposure, mAs. (Calculated from exposure time and xraytubecurrent)

bodypartthickness

Thickness of breast when compressed during exposure.

compressionforce

Compression force applied to breast during exposure.

rows

Number of rows in the images, height.

columns

Number of columns in the image, width.

bitsallocated

Number of bits allocated for each image pixel.

bitsstored

Number of bits stored for each image pixel in image file.

examination

Type of examination performed, e.g. mammography examination using two images.

series

A set of images in examination.

dateOfSecondaryCapture

Date of scanning analog image at MEB.

Area based density measurement

For detailed information, see <http://breast-cancer-research.com/content/14/4/R114>

density_percent

Breast density score. The score from 0 to 100 percent shows how much whiteness is available on the mammogram images.

densearea_px

Area of dense part of breast measured in pixels.

breastarea_px

Total breast area measured in pixels.

Volumetric breast density measurement

Volumetric breast density measurements is performed with Volpara

xraysystem

X-ray system used by machine.

targetmaterial

Target material used by machine.

filtermaterial

filter material used by machine.

Breastvolumecm3

Breast volume in cm³ (total volume).

Hintvolumecm3

Dense volume of breast in cm³.

volumetricbreastdensity

Volumetric breast density in percent (dense volume divided by total breast volume). (Density in the range 0-<4.5 corresponds to the visual density grade BI-RADS I, 4.5-<7.5 is BI-RADS II, 7.5-<15.5 is BI-RADS III, 15- is BI-RADS IV)

v1.5.0 and later:

CompressionPressureKPa

Compression force per unit. This is a measure of mammographic compression that takes into account the varying breast sizes e.g. a measure of force applied per unit area. Certain groups, e.g. LRCB, are investigating whether compression pressure may be a better way to standardize compression.

This is calculated as: $\text{Compression Pressure (kPa)} = \frac{[\text{Compression Force (N)}]}{[\text{Contact Area of the Breast (mm}^2)]} \times 1000$

ContactAreaMm2

Breast contact area against compression paddle. This is the contact area of the breast in mm^2 , as estimated from the image, by Volpara

ComputedSlantAngle and ComputedSlantMm

Volpara now outputs a measure of the estimated tilt of the compression paddle, in either degrees or millimeters. Previously, Volpara used a default tilt estimate per manufacturer, but will not attempt to estimate the actual tilt. This was implemented in part due to the use of flexible paddles (e.g. Hologics FAST paddle), which when used with high enough compression, can result in large tilting of the compression paddles.

EntranceDoseInmGy

This is the average entrance dose (in mGy) at the surface of the breast, as reported in the DICOM header information by the manufacturer.

OrganDoseInmGy

This is the mean glandular dose (in mGy) to the breast, as reported in the DICOM header information by the manufacturer.

GlandularityPercent

This is Volpara's estimate of Dance's glandularity i.e. Volpara converts the volumetric breast density (%) to an estimate of the breast glandularity.

VolparaMeanGlandularDoseInmGy

This is a patient-specific estimate of the mean glandular dose (in mGy). Volpara uses Dance's model irrespective of the manufacturer (different vendors implement different models, some use Wu et al. some use Dance et al etc). Volpara also uses a patient-specific estimate of glandularity based on the volumetric breast densities (different vendors make different assumptions about breast density, often based on breast thickness).

OperatorName

This is taken from the DICOM tag "OperatorsName". Since we are doing more work around quality assurance, sometimes it is useful to stratify data by operator/technologist, to look at e.g. whether some operators are using higher/lower compression force and subsequently whether the women they have imaged have received lower/higher mean glandular dose.

System variables

round_imaging

Round of mammography visit for the study participant, i.e. the order number of times the study participant did a mammography. Used for stratifying participant mammography rounds.

year_imaging

Year of mammography. Used for stratifying time series data.

month_imaging

Month of mammography. Used for stratifying time series data.

source_imaging

Available imaging data.

mammography_date

Date of mammography. The date the mammography was performed.